

# South Dakota AFNR

## *Academic Integration Activities: Example #6*

→ *Animal Science students distinguish between experimental and theoretical probability as it relates to genetic outcomes.*

### **1. Ag Standard**

*Fundamental Animal Science—AN4.3*

Predict genetic outcomes.

> Determine genotype and phenotype.

### **2. Academic Standard**

*9-12.S.2.1*

Students are able to distinguish between experimental and theoretical probability.

### **3. Background Information**

Probability: Likelihood an event will occur expressed as a ratio.

Experimental probability: Conduct an experiment to determine probability.

$$\text{Experimental probability} = \frac{\text{Number of event occurrences}}{\text{Number of total trials}}$$

Theoretical probability: Use equation to determine probability.

$$\text{Theoretical probability} = \frac{\text{Number of favorable outcomes}}{\text{Number of total outcomes}}$$

Example: Determine which of the two activities represents experimental probability:

- Roll two dice many times, record the sums, and write the probabilities of different sums
- Create a sample space of all possible outcomes and write the probabilities of different sums

*Answer:*

*a = experimental*

*b = theoretical*

### **4. Example in Context**

Which activity represents theoretical probability? Which activity represents experimental probability?

- Mate a Hereford bull with twenty Angus heifers, record the calves' phenotypes, and write the probabilities of different phenotypes
- Create a sample space of probable outcomes and write the probabilities of different phenotypes

*Answer:*

*a = experimental probability. This would involve an actual experiment being conducted to determine the ratios of phenotypes.*

*b = theoretical probability. The theoretical probability formula would be used for activity b.*

## **5. Guided Practice Exercise**

Which activity represents theoretical probability?

- a. Make a list of likely results and calculate the probability of one plant producing four tomatoes
- b. Grow many tomato plants, record the number of tomatoes produced by each one, and record the probability of one plant producing four tomatoes

*Answer: A. The first activity shows how a theoretical ratio could be found without an actual experiment being conducted.*

## **6. Independent Practice Exercises**

Which activity represents experimental probability?

- a. Name the probable outcomes, and write the probability of having a white mouse after breeding two black mice together
- b. Breed several black mice to other black mice, record the number of white offspring, and write the probability of having a white mouse

*Answer: B.*

Which activity represents theoretical probability?

- a. Create a sample space of probable outcomes, and write the probability of producing a normal rabbit after mating an albino rabbit with a brown rabbit
- b. Mate an albino rabbit with a brown rabbit, record the number of normal (non albino) rabbits, and write the probability of having a normal rabbit

*Answer: A.*

## **7. Notes**

Students in Ag class could actually complete each of the activities to determine the phenotype outcome and help them learn genetic principles. After doing the activities – theoretically and experimentally – students can identify which method demonstrated each type of probability calculation.